Semester V

Course No.	Courses	Credit		
		T	P	Total
A)	**Core Course**			
AGRO359	Practical Crop Production-I (Kharif crops)	0	1	1
AHDS 353	Technology of Milk and Milk Products.	1	1	2
BOT 353	Intellectual Property Right	1	0	1
ECON 353	Agricultural Marketing Trade and Prices	2	1	3
ENTO 354	Pests of Crops and Stored Grain and their Management- I	1	1	2
GPB 355	Crop Improvement – I (Kharif Crops)	1	1	2
HORT 354	Production Technology for Ornamental Crops, MAP and Landscaping	1	1	2
PATH 354	Diseases of Field and Horticultural Crops and their Management	2	1	3
SSAC 353	Manures, Fertilizers and Soil Fertility Management	2	1	3
	Subtotal	**11**	**8**	**19**
B)	**Common Courses**			
EXTN 355	Entrepreneurship Development and Business Communication	1	1	2
	Subtotal	**1**	**1**	**2**
C)	**Elective Course (3 credits)**			
AGRO3510	Weed Management	2	1	3
ELE ECON 354	Agribusiness Management	2	1	3
ELE FST 351	Food Safety and Standards	2	1	3
ELE HORT 355	Protected Cultivation of Horticultural Crops	2	1	3
	Subtotal	**2**	**1**	**3**
	Total (A+B+C)	**14**	**10**	**24**

Course :	*AGRO 359*		***Credit:***	*1(0+1)*	***Semester-V***
Course title:	*Practical Crop Production-I (Kharif crops)*				

Syllabus

Practical : Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.**Study of farm inventories and records*,**

(To get practical oriented knowledge to the student, 2 R area per student will be allotted for raising *kharif*crop of the region. The student has to raise the crop from sowing to harvesting threshing, drying, winnowing, storage and preparation of produce for marketing. Also he has to study the cost of cultivation, net return per student as well as per team of a group of students.*)

(Note : * new inclusion)

Teaching Schedule

Practical

Experiment	Topic
1	Introduction, aims and objectives of practical crop production – Allotment of plot and its history.
2	Study of seed production of *kharif* crops
3	Study of mechanization and resource conservation of *kharif* crops
4	Study of physical and chemical properties of the allotted plot to the students.
5	Study of package of practices for growing *kharif* crop (timely, late and rainfed).
6	Study of farm inventories and records
7	Preparation of calendar of operation for *kharif* crop.
8	Study of preparatory, secondary tillage and seed bed preparation for *kharif* crop.
9	Sowing and seed treatment of *kharif* crop.
10	Study of integrated nutrient management of *kharif* crop.
11	Study of water management to *kharif* crop.
12	Determination of germination/emergence count of *kharif* crop.
13	Study of growth and yield contributing characters of *kharif* crop.
14	Study of interculturing and weed management in *kharif*crop.
15	Study of integrated insect pest and diseases management in *kharif* crop
16	Study of crop maturity signs and harvesting of*kharif crops*
17	Threshing, drying, winnowing, storage and preparation of produce for marketing of *kharif* crop.

Experiment	Topic
18	Study of cost of cultivation and working out net returns per student
19	Study of post harvest technology of *kharif* crop.
20	Summary report of practical crop production
21	Study of weekly weather record for *kharif*season.

Note :

To get practical oriented knowledge to the student, 2 R area per student will be allotted for raising *kharif*crop of the region. The student has to raise the crop from sowing to harvesting threshing, drying, winnowing, storage and preparation of produce for marketing. Also he has to study the cost of cultivation, net return per student as well as per team of a group of students

Suggested Readings:

1. *Modern technique of raising field crops by Chiddasingh*
2. *Agronomy of field crop by S.R. Reddy*
3. *Hand book of Agriculture, ICAR New Delhi*

Course :	*ELE AGRO 3510*		***Credit:***	*3(2+1)*	***Semester-V***
Course title:	*Weed Management (Elective)*				

Syllabus

Theory : Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

Practical :Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agro-chemicals study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipment's. Calculations of herbicide doses and weed control efficiency and weed index.

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
1-2	Introduction and importance of weeds	6
3-4	Characteristics of weeds	6
5-6	Harmful and beneficial effects of weeds on ecosystem.	8
7-8	Classification of weeds, Shift of weed flora	6
9-10	Reproduction and dissemination of weeds	8
11	Classification of herbicides	6
12-13	Concept of adjuvant and surfactants	6
14	Herbicide formulation and their use	4
15-16	Introduction to mode of action of herbicides	6
17	Introduction to herbicide selectivity	4
18-19	Allelopathy and its application in weed management	8
20-21	Bio herbicides and their application in Agriculture	8
22-23	Concept of herbicide mixture and its utility in Agriculture	6
24-25	Herbicide compatibility with Agrochemicals	4
26	Herbicide compatibility with fertilizers	2
27-28	Integration of herbicides with non chemical methods of weed management	6
29-30	Herbicide resistance and its management	6
	Total	**100**

b) Practical

Experiment	Topic
1-2	Identification of weeds
3	Techniques of weed preservation
4	Study of losses caused by weeds
5 - 6	Biology of important weeds
7	Study of herbicide formulation and herbicide mixtures
8	Study of herbicide in relation to Agrochemicals
9	Phyto-toxicity symptoms on crops and its measurement
10	Methods of herbicide application
11-12	Herbicides application equipments and their calibration
13	Calculation of herbicide dose
14	Computation of different weed indices
15	Visit to weed management experiments

Suggested Readings:

1) Aldrich, R.J. and Kramer R.J. (1997), Principles in Weed Management.
2) Gupta O.P. (2007), Weed management Principles and Practices.
3) Gupta, O.P. (2008), Modern Weed Management
4) Gupta, O.P. 1984. Scientific Weed Management Today and Tomorrows.
5) Jayakumar, R. andJagannathan, R. (2007). Weed Science Principles.
6) Mandal R.C. (1999), Weed, Weedicides and Weed control Principles and Practices.
7) Rao V.S. (2006), Principles of Weed Science.

Course :	*GPB 355*		***Credit:***	*2(1+1)*	***Semester-V***
Course title:	*Crop Improvement –I (Kharif Crops)*				

Syllabus

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Teaching Schedule

a) Theory

Lecture	Topic	Weightages (%)
1	Centre of origin, Distribution of species, wild relative in different crops **Cereals**- Rice, Maize, Sorghum, Pearl millet, Ffinger millet.	4

Lecture	Topic	Weightages (%)
	Pulses-Pigeonpea, Urdbean, Black gram, Mung bean, Cowpea, Soybean. **Oil seed-** Groundnut, Castor, Sesame, Sunflower.	
2	**Fodder:**Berseem, Lucerne, rice bean. **Cash crops:** Cotton, Tobacco. **Vegetable:** Ridge gourd, bottle gourd, Snake gourd, Bitter gourd. **Horticultural crop-** Mango, Cashewnut, Citrus, Pomegranate, Guava.	4
3	Definition of PGR, Gene pool, Kinds of germplasm, gene pool concept, Genetic erosion, Germplasm collection and conservation, Types and methods.	10
4 &5	Floral Biology- Emasculation and mode of pollination (Definition and Types) Study of genetics of qualitative and quantitative characters- Inheritance of qualitative characters, pleiotrophy, Penetrance and Expressivity, Threshold character and modifying genes. Inheritance of quantitative character- Multiple factor hypothesis, Transgenic segregation, Role of environment of quantitative inheritance, Difference between quantitative and qualitative character	10
6'7 &8	Major Specific Breeding objective, Conventional Breeding methods- Introduction, Mass selection, pure line selection, Pedigree method, Bulk method and backcross method along with examples of varieties. Modern innovative approaches- somatic Hybridization, transgenic breeding and marker assisted selection.	20
9& 10	**Biotic stress tolerance: Breeding for disease and insect resistance** **Disease resistance**: Introduction, mechanism of disease resistance genetic resistance type of genetic resistance, gene for gene hypothesis, Genetics of resistance sources of resistance breeding methods and practical achievement. **Insect resistance**: Introduction, mechanism of insect resistance basis of insect resistance, Genetics of insect resistance sources of insect resistance, breeding methods, practical achievement.	12
11 & 12	**Breeding for Abiotic stress:** **Drought resistance-** Drought introduction, Drought resistance, Mechanism of drought resistance, Basis of drought resistance sources of drought resistance, breeding method. **Salinity:** Breeding for salt tolerance, breeding approaches, screening techniques, practical achievements. **Breeding for quality:** Introduction, Quality traits, Nutrition and nutrients, Nutritional quality of cereals and pulses, Genetic of nutritional traits, Sources of nutritional quality, Breeding methods, screening techniques, Breeding for low toxic substance, practical achievements.	12
13	**Seed production technology in self pollinated crops-** Rice wheat, Cross pollinated -Maize, Sorghum Vegetatively propagated crop. Potato, Sugarcane	8
14	Hybrid seed production of Maize, Rice Sorghum, Pigeonpea and	8

Lecture	Topic	Weightages (%)
	Pearl millet.	
15 & 16	Ideotype concept in crop improvement- Introduction, Types of ideotype, characteristics of Ideotype, Major steps in Ideotype breeding, Ideotype of Rice, wheat, Sorghum, practical achievements, merits and demerits. Characteristics of climate resilient crops Viz. Wheat, Sorghum, maize, soybean, cotton,	12
	Total	**100**

b) Practical

Experiment	Topic
1	Emasculation and hybridization techniques in different crop species : Rice, Maize
2	Emasculation and hybridization techniques in Sorghum & Pearl Millet
3	Emasculation and hybridization techniques in Ragi&Pigeonpean
4	Emasculation and hybridization techniques in Urdbean&Mungbean, Soybean
5	Emasculation and hybridization techniques in Groundnut, Seasame& Sunflower
6	Emasculation and hybridization techniques in Caster, Cotton
7	Emasculation and hybridization techniques in Cowpea & Tobacco
8	Maintenance breeding of different Kharif crops
9	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods
10	Study of field techniques for seed production and hybrid seeds production in Kharif crops
11	Estimation of heterosis, inbreeding depression and heritability
12	Layout of field experiments
13	Study of quality characters, donor parents for different characters
14	Visit to seed production plots
15	Visit to AICRP plots of pulse & sorghum
16	Visit to AICRP plots of oilseed & cotton

Suggested Reading:

Sr. No	Title of Book	Author/Authors	Publisher
1.	Crop Breeding and Biotechnology	HariHar Ram	KalyaniPublication New Delhi.
2.	Breeding of Asian Field crops	D. A. Sleper J.M. Poehlman	Blackwell Publishers
3.	Principle and Procedures of Plant Breeding Biotechnological and Conventional Approach	G. S. Chahal S. S. Gosla	Narosa Publishers House. New Delhi.
4.	Plant Breeding Principle and Methods.	B. D. Singh	KalyaniPublication New Delhi.

Course :	*BOT 353*		***Credit:***	*1(1+0)*	***Semester-V***
Course title:	*Intellectual Property Right*				

Syllabus

Theory

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.

Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights,

Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders.

Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Teaching Schedule

Lecture	Topic	Weightage (%)
1-2	Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO	**10**
3	Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.	**5**
4-5	Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.	**15**
6-7	Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation,	**12**
8	Penalties for infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.	**4**
9-10	**UPOV-** Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV	**14**
11-12	PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001	**14**
13-14	Researcher and farmers rights, Traditional knowledge-meaning and rights of TK holders.	**12**
15-16	Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological diversity Act,2002 and its salient features, access and benefit sharing	**14**
	Total	**100**

Suggested Readings:

1) *Introduction to Intellectual Property Rights by H.S. Chawla, Oxford & IBH Publishing Co. Pvt. Ltd. 113-B ShahpurJat, 2nd Floor, Asian Games Village side New Delhi 110 049, India*
2) *Encyclopedia of Intellectual Property rights Volume No. 1 to 10 by Priyanjan Trivedi (2008)*
3) *Plant Breeding by B.D. Singh (2006), Kalyani Publication*
4) *Intellectual Property Right Under Golbalization by Tawar S. Serials Publication, New Delhi.*

Course :	*ENTO 354*		***Credit:***	*2(1+1)*	***Semester-V***
Course title:	*Pests of Crops and Stored Grain and their Management*				

Syllabus

Theory

General account on nature and type of damage by different arthropods pests: Scientific name, order, family, host range, distribution, biology, nature of damage and management of insect pests of **Cereals-Rice -** Paddy stem borer, Green leaf hopper, Brown plant hopper, White backed plant hopper, Gall midge, Paddy grasshopper, Blue beetle, Caseworm, Armyworm, Gundhi bug, Hispa, Leaf folder. **Sorghum –** Shoot fly, Stem borer, Aphids, Delphacids, Grasshopper, Earhead midge, Earhead caterpillars. **Maize –** Shoot fly, Stem borer, Armyworm, Cob earworm. **Bajra –** Shoot fly, Blister beetle. **Wheat –** Stem borer, Aphids, Termites. **Minor millets. Pulses – Pigeon pea**, **chickpea, mungbean, urdbean, cowpea, pea. Pigeon pea** – Pod borer, Plume moth, Pod fly, Spotted pod borer, Leaf webber, Mites. **Chickpea –** Gram pod borer, Aphids, Cutworm. **Mung and Urdbean** – Aphids, Leaf eating caterpillar, Semilooper, Pod borer. **Cowpea and Pea** – Aphids, Blue butterfly, Pod borer. **Oilseeds -Groundnut** – Leaf miner, Hairy caterpillar, Tobacco leaf eating caterpillar, Aphids, Thrips, White grub, Pod sucking bug. **Castor** – Semilooper, Capsule borer, Jassids, Tobacco leaf eating caterpillar. **Sunflower** – Capitulum borer, Hairy caterpillar, Jassids, Thrips, Whitefly, Stem borer. **Safflower-** aphids, Capitulum borer, Guzia weevil. **Mustard –** Aphids, Sawfly, Leaf webber. **Linseed –** Gall fly. **Soybean –** Stem fly, Girdle beetle, Leaf miner, Tobacco leaf eating caterpillar, Whitefly, Semilooper, Gram pod borer. **Sesamum –**Til hawk moth, Gall fly, leaf eating caterpillar. **Niger –**Semilooper, Gram pod borer. **Fiber crops –Cotton –** Aphids, Jassids, Thrips, Whitefly, Mealy bugs, Spotted bollworm, American bollworm, Pink bollworm, Tobacco leaf eating caterpillar, Leaf folder, Semilooper, Red cotton bug, Dusky cotton bug, Grey weevil. **Sunhemp and Mesta** – Sunhemp hairy caterpillar. **Sugarcane crops** - Early shoot borer, Internode borer, Top shoot borer, Whitefly, Pyrilla, Woolly aphids, Mealy bug, Scale insect, Termites, White grub. **Non-insect pests of above crops –** Crabs, Snails and Slugs, millepedes, Mites, Rats and squirrels. **Stored grain pests -** Biology and damage of Primary and Secondary pests. Primary store grain pests- Internal feeders - Rice weevil, lesser grain borer, pulse beetle and Angoumois grain moth. External feeders - khapra beetle, Indian meal moth. Secondary store grain pests – Rust red flour beetle, Saw toothed grain beetle, Long headed beetle. Primary and Secondary store grain pests - Rice moth. Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Preventive and curative methods of stored grain pests. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different type of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce. ***Field crops: Cereals****-Rice, Sorghum, Maize, Bajra, Wheat and Miner millets.* ***Pulses****- Pigeon pea, Chickpea, Mung bean, Urd bean, Cowpea and Pea.* ***Oilseeds:*** *Groundnut, Castor, Sunflower, Safflower, Mustard, Linseed, Soybean, Sesamum and Niger.* ***Fibre:*** *Cotton, Sunhemp and*

*Mesta. **Sugar crop:** sugarcane. Non insect pests of field crops. Store grain pests. Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Preventive and curative methods of stored grain pests. Storage structure and methods of grain storage and fundamental principles of grain store management.*

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
	Distribution, biology, nature of damage and management of insect pests of ….	20
	Cereals	
1	Rice - Paddy stem borer, Green leaf hopper, Brown plant hopper, White backed plant hopper, Gall midge, Paddy grasshopper, Blue beetle, Caseworm, Armyworm, Gundhi bug, Hispa, Leaf folder	
2	Sorghum – Shoot fly, Stem borer, Aphids, Delphacids, Grasshopper, Earhead midge, Earhead caterpillars	
3	Maize – Shoot fly, Stem borer, Armyworm, Cob earworm	
	Bajra – Shoot fly, Blister beetle	
	Wheat – Stem borer, Aphids, Termites,	
	Minor millets -	
	Pulses – Pigeon pea, **chickpea, mungbean, urdbean, cowpea, pea**	10
4	Pigeon pea – Pod borer, Plume moth, Pod fly, Spotted pod borer, Leaf webber, Mites	
5	Chickpea – Gram pod borer, Aphids, Cutworm	
	Mung and Urdbean – Aphids, Leaf eating caterpillar, Semilooper, Pod borer	
	Cowpea and Pea – Aphids, Blue butterfly, Pod borer	
	Oilseeds -	20
6	Groundnut – Leaf miner, Hairy caterpillar, Tobacco leaf eating caterpillar, Aphids, Thrips, White grub, Pod sucking bug	
7	Castor – Semilooper, Capsule borer, Jassids, Tobacco leaf eating caterpillar	
	Sunflower – Capitulum borer, Hairy caterpillar, Jassids, Thrips, Whitefly, Stem borer	
8	Safflower – Aphids, Capitulum borer, Guzia weevil	
	Mustard – Aphids, Sawfly, Leaf webber	
	Linseed – Gall fly	
9	Soybean – Stem fly, Girdle beetle, Leaf miner, Tobacco leaf eating caterpillar, Whitefly, Semilooper, Gram pod borer	
	Sesamum – Til hawk moth, Gall fly, leaf eating caterpillar	
	Niger – Semilooper, Gram pod borer	
	Fiber crops –	10

Lecture	Topic	Weightage (%)
10-11	Cotton – Aphids, Jassids, Thrips, Whitefly, Mealy bugs, Spotted bollworm, American bollworm, Pink bollworm, Tobacco leaf eating caterpillar, Leaf folder, Semilooper, Red cotton bug, Dusky cotton bug, Grey weevil	
	Sunhemp and Mesta – Sunhemp hairy caterpillar	
	Sugarcane crops	10
12	Sugarcane – Early shoot borer, Internode borer, Top shoot borer, Whitefly, Pyrilla, Woolly aphids, Mealy bug, Scale insect, Termites, White grub	
13	**Non-insect pests of above crops –** Crabs, Snails and Slugs, millepedes, Mites, Rats and squirrels	10
14-15	**Stored grain pests -** Biology and damage of Primary and Secondary pests Primary store grain pests- Internal feeders - Rice weevil, lesser grain borer, pulse beetle and Angoumois grain moth External feeders - khapra beetle, Indian meal moth Secondary store grain pests – Rust red flour beetle, Saw toothed grain beetle, Long headed beetle Primary and Secondary store grain pests - Rice moth	20
16	Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management	
17	Preventive and curative methods of stored grain pests	
18	Storage structure and methods of grain storage and fundamental principles of grain store management.	
	Total	**100**

b) Practical

Experiment	Topic
1.	Pests of Rice
2.	Pests of Sorghum
3.	Pests of Maize, Bajra, Wheat and Miner millets
4.	Pests of Pigeon pea
5.	Pests of Chickpea, Mung bean, Urd bean, Cowpea and Pea
6.	Pests of Groundnut
7.	Pests of Castor and Sunflower
8.	Pests of Safflower, Mustard, Linseed
9.	Pests of Soybean, Sesamum and Niger

Experiment	Topic
10 & 11.	Pests of Cotton, Sunhemp and Mesta
12.	Pests of Sugarcane
13.	Non insect pests of field crops
14 & 15.	Store grain pests
16.	Non insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management
17.	Preventive and curative methods of stored grain pests
18.	Storage structure and methods of grain storage and fundamental principles of grain store management.

Marks distribution for practical examination

1. *Spotting -36*
2. *Viva-voce -04*
3. *Practical manual-5*
4. *Collection-5*

Suggested Readings:

1) *A.S. Atwal and G.S. Dhaliwal :Agricultural Pests of South Asia and their Management*
2) *B.V. David and V.V. Rammurthy: Elements of Economic Entomology*
3) *Manishekharan and Sudarrajan : Pest Management in Field Crops.*
4) *Pedigo L.P. : Entomology and Pest Management.*
5) *VenuGopalRao: Insect Pest Management.*
6) *B.P. Khare : Storage Entomology*

Course :	*HORT 354*		***Credit:***	*2(1+1)*	***Semester-V***
Course title:	*Production Technology for Ornamental Crops, MAP and Landscaping*				

Syllabus

Theory

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping.Principles of landscaping.Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions.Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella,palmarosa, ocimum, rose, geranium, vetiver.Processing and value addition in ornamental crops and MAPs produce.

Practical

Identification of Ornamental plants.Identification of Medicinal and Aromatic Plants.Nursery bed preparation and seed sowing.Training and pruning of Ornamental plants.Planning and layout of garden.Bed preparation and planting of MAP.Protected structures – care and maintenance.Intercultural operations in flowers and MAP. Harvesting and post harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Teaching Schedules:

a) Theory

Lecture	Topic	Weightage (%)
1	Importance and scope of ornamental crops and landscaping	10
2	Importance and scope of medicinal and aromatic plants	
3	Principles of landscaping	10
4	Landscape uses of trees, shrubs and climbers	
5	Production technology of important cut flowers like rose under protected conditions	10
6	Production technology of important cut flowers like gerbera, carnation under protected conditions	10
7	Production technology of important cut flowers like lilium and orchids under protected conditions	05
8	Production technology of important cut flowers like gladiolus, tuberose under open conditions.	10
9	Production technology of important cut flowers like chrysanthemum under open conditions.	10
10	Package of practices for loose flowers like marigold and jasmine under open conditions.	10
11	Production technology of important medicinal plants like asparagus, aloe, costus.	05
12	Production technology of important medicinal plants like Cinnamon, periwinkle, isabgol	
13	Production technology of important aromatic plants like mint, lemongrass, citronella,palmarosa.	10
14	Production technology of important aromatic plants like ocimum, rose, geranium, vetiver.	
15	Processing and value addition in ornamental crops	05
16	Processing and value addition in MAPs produce	05

b) Practical

Practical No.	Topic
1	Identification of Ornamental plants and flower crops
2	Identification of Medicinal and Aromatic Plants
3	Propagation of Ornamental plant
4	Propagation of medicinal and aromatic plants
5	Nursery bed preparation and seed sowing

6	Training and pruning of Ornamental plants
7	Planning and layout of garden
8	Bed preparation and planting of MAP
9	Protected structures – care and maintenance
10	Intercultural operations in flowers
11	Intercultural operations in MAP
12	Harvesting and post harvest handling of cut flowers
13	Harvesting and post harvest handling of loose flowers
14	Processing of MAP
15	Visit to commercial flower
16	Visit to MAP unit

Suggested Readings:

Book	Title of Book	Authors
1	Floriculture and Landscaping	T.K.bose
2	Floriculture in India	Randhawa and Mukhopadhay
3	Fundamentals of Floriculture	Laury
4	*Complete Home Gardening*	Dey, S.C.
5	*Landscape Gardening & Design with Plants* –	Supriya Kumar Bhattacharjee
6	*Landscaping principles and practices* –	Jack E. Ingels

Course :	*ELE HORT 355*		***Credit:***	*3(2+1)*	***Semester-V***
Course title:	*Protected cultivation of horticultural crops*				

Syllabus

Theory

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management.Types of benches and containers.Irrigation and fertigationmanagement.Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants.Off-season production of flowers and vegetables.Insect pest and disease management.

Practical

Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, Bed preparation and planting of crop for production,

Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging and misting.

Teaching Schedule:

a) Theory

Lecture	Topic	Weightage (%)
1-4	Protected cultivation- importance and scope in India Current status of protected cultivation in India and World	10
5-6	Types of protected structure based on site and climate, cladding material involved in greenhouse/ poly house	10
7-8	Greenhouse design, environment control, artificial lights, automation	5
9-11	Soil preparation and management, substrate management, types of benches and containers	10
12-13	Irrigation and fertigation management	10
14-15	Propagation and production of quality planting material of horticultural crops	5
16-24	Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, etc	15
25-29	Greenhouse cultivation of important horticultural crops like tomato, bell pepper, cucumber, strawberry, pot plants. Cultivation of economically important medicinal and aromatic plants	20
30	Off-season production of flowers and vegetables	5
31-32	Insect pest and disease management	10

Practical

Experiment	Topic
1	Raising of seedlings and saplings under protected conditions Use of protrays in quality planting material production
2	Bed preparation and planting of crop for production
	Inter cultural operations of flower and vegetable crops
3	Green bending, disbudding, deshooting in roses
4	Supporting, pinching and disbudding in carnation
5	Deleafing, disbudding, in gerbera
6-7	Training, pruning of tomato, bell pepper, cucumber, etc.
8	Soil and water EC and pH measurement as per crop need
9	Regulation of irrigation and fertilizers through drip, fogging and misting
10-11	Harvesting, Precooling, grading, packing, storage of – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, etc.
12-13	Harvesting, Precooling, grading, packing, storage of tomato, bell pepper, cucumber, strawberry, pot plants, etc.
14-15	Pest and disease management of flower and vegetable crops
16	Visit to commercial units and market

Suggested Readings:

1) S.D. Warade. 2003. Protected cultivation of Horticulture crops, CAFT(fruits), MPKV, Rahuri
2) Balraj Singh. 2005. Protected cultivation of vegetable crops, Kalyani publishers, New Delhi
3) Commercial Floriculture – Prasad & Kumar.
4) Proceedings of International seminar on protected cultivation in India, held at Bangalore (1997)
5) Greenhouse operation and management- Paul. V. Nelson
6) Patil, M.T and Patil, P.V. 2004. Commercial Protected Floriculture, MPKV, Rahuri

Course :	*ECON 353*		***Credit:***	*3(2+1)*	***Semester-V***
Course title:	*Agricultural Marketing Trade and Prices*				

Syllabus

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets**;** demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products,

Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions:

Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel;number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs;

Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures

trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy;

Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

Plotting and study of demand and supply curves and calculation of elasticities**;** Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

Teaching Schedule

a) Theory

Lecture	Topic/Lesson	Weightage
1	Market and Marketing – Meaning – Definitions – Components of market – Market structure – Meaning – Components – Market conduct – Market performance	2
2	Agricultural Marketing – Meaning – Definition – Scope – Subject matter – Importance of Agricultural Marketing in economic development.	2
3	Classification of markets – On the basis of location, Area of coverage, time span, volume of transaction, nature of transaction, number of commodities, degree of competition, nature of commodities, stage of marketing, extent of public intervention, type of population served, accrual of marketing margins	4
4	Marketing mix and market segmentation,	2
5	Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products,	2
6	Producers surplus- Meaning- Marketable surplus- Marketed surplus-importance- factors influencing marketable surplus- Marketing channels - Definition	3
7	Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC;	4
8	Strategies in different stages of PLC; pricing and promotion strategies:	3
9	Pricing considerations and approaches –cost based and competition based pricing;	3

Lecture	Topic/Lesson	Weightage
10	Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits;	4
11	Marketing process and functions: Marketing process-concentration, dispersion and equalization;	3
12	Marketing functions – Meaning -exchange functions – buying and selling;	2
13	Physical functions – storage, transport and processing	3
14	Facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);	4
15	Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing;	5
16	Meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products;	4
17	Market integration-definition-types of market integration-horizontal, vertical and conglomeration-	4
18	Marketing efficiency-meaning-definitions-technical or physical or operational efficiency-pricing or allocative efficiency	5
19	Marketing cost-margins-price spread-factors affecting the costs of marketing-reasons for higher marketing costs of agricultural commodities- ways of reducing marketing costs for farm products.	3
20	Role of Govt. in agricultural marketing- Remedial measures-Regulated markets-definition-important features of regulated markets, functions, progress and defects	4
21	Public sector institutions- Warehousing-meaning- warehousing in India - Central Warehousing Corporation(CWC)- working of warehouses -advantages- State Warehousing Corporations (SWC)-Food Corporation of India(FCI)-objectives- functions	3
22	Characteristics of agricultural product prices-agricultural price stabilization-need for agricultural price policy- commission for Agricultural cost and Prices (CACP)- administered prices-minimum support price, procurement price and issue price.	3
23	Cooperative marketing- meaning-structure- Functions of cooperative marketing societies-.	2
24	National Agricultural Cooperative Marketing Federation (NAFED) and State Agricultural Cooperative Marketing Federations (MARKFED)- State Trading-objectives-Types of state trading.	4
25	Risk in marketing: Types of risk in marketing;	3
26	Speculation & hedging; an overview of futures trading;	2
27	Characteristics of agricultural product prices-agricultural price stabilization-need for agricultural price policy- commission for Agricultural cost and Prices (CACP)- administered prices-minimum support price, procurement price and issue price	4
28	Trade: Concept of International Trade and its need, International trade-definition-difference between international and inter-	3

Lecture	Topic/Lesson	Weightage
	regional trade- free trade vs protection.	
29	Theories of absolute and comparative advantage.	3
30	Present status and prospects of international trade in agri-commodities; GATT and WTO;	2
31	Agreement on Agriculture (AoA) and its implications on Indian agriculture;Trade Related Intellectual Property Rights(TRIPS)	2
32	Market and Marketing – Meaning – Definitions – Components of market – Market structure – Meaning – Components – Market conduct – Market performance	3
	Total	**100**

b) Practical

Exercise	Topic
1	Plotting and study of demand and supply curves
2	Calculation of elasticities
3	Study of relationship between market arrivals and prices of some selected commodities
4	Computation of marketable and marketed surplus of important commodities
5	Study of price behaviour over time for some selected commodities;
6	Visit to a local market to study various marketing functions performed by different agencies,
7	Visit to regulated market
8	Identification of marketing channels for selected commodity
9	Collection of data regarding marketing costs, margins and price spread.
10	Presentation of report in the class.
11	Visit to market institution – NAFED to study their organization and functioning.
12	Visit to SWC to study their organization and functioning.
13	Visit to CWC to study their organization and functioning.
14	Visit to cooperative marketing society to study their organization and functioning.
15	Application of principles of comparative advantage of international trade.
16	Final practical exam.

Suggested Readings:

1) Acharya S.S and Agarwal NL, 2006, Agricultural Marketing in India. Oxford & IBH Publishing Co.Pvt.Ltd. New Delhi
2) Kahlon, A.S and Tyagi.D S, 1983 Agricultural Price Policy in India. Allied Publishers

Pvt. Ltd., New Delhi.

3) Kulkarni, K R.1964, Agricultural Marketing in India. The Co-operators Books Depot, Mumbai.
4) Mamoria, C.B. and Joshi. R L.1995, Principles and Practices of Marketing in India, Kitab Mahal, Allahabad
5) Mamoria, C.B., 1973., Agricultural Problems in India, Kitab Mahal, Allahabad
6) Subba Reddy, S., P.Raghu Ram., P. Sastry, T.V.N. and Bhavani Devi I. 2010. Agricultural Economics., Oxford & IBH Publishing Company Private Ltd., New Delhi, 2010

Course :	*ELE ECON 354*		***Credit:***	*3(2+1)*	***Semester-V***
Course title:	*Agribusiness Management*				

Syllabus

Theory

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

Practical

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks,

RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Teaching Schedule

a) Theory

Lecture	Details of Topic	Weightage
1	Agribusiness: Meaning of Agribusiness, Definition of Agribusiness, Transformation of agriculture into agribusiness, Various stakeholders and components of Agribusiness systems.Agricultural Input Sector, Production Sector, Processing Manufacturing Sector, Distribution-Marketing Sector.	5
2, 3 & 4	Importance of Agribusiness in Indian Economy New Agricultural Policies *National Agril. Policy, National Seed Policy, National Price Policy, National Food Processing Policy, National Foreign Trade Policy, National Fishery Policy, National Food Security Policy, National Food & Biotech, National Transportation of Food, National Nutrient Based Subsidy*	4
5 & 6	Agro-based Industries: Importance of Agro based Industries , Need of Agro based Industries, Classification of Agro based Industries, Types of Agro based Industries- Sugar Mills, Cotton Ginning Mills, Dal Mills, Rice Mills, Poha Mills, Fruit Processing Industries etc. Institutional Arrangement- Ministry of Agriculture (GOI), Financial Institutions, NABARD, NCDC, NDDB, NCUI, APEDA, ICAR, NAFED, FCI, CWC, NHM, CFTRI, EPO	7
7	Procedure to set up agro-based Industries Constraints in establishing Agro based Industries	4
8 & 9	Agricultural Value Chain : Value Chain Concept Primary activities and support activities and their linkages, Supply Chain v/s. Value Chain, Vertical Corporation, Horizontal relation, Nature of Association. Business Process and Agribusiness Supply Chain- Production, Processing/Manufacturing, Wholesaling, Retailing, Logistics, Supply Network	5
10	Business Environment PEST Analysis(Political, Economic, Social & Technological) SWOT Analysis (Strengths, Weaknesses Opportunities and Threats)	3
11	Management Functions: Role and Activities, Organization Culture, Functions of Management- Planning, Organizing, Directing, Controlling, Coordinating, Financing	2
12	Planning *Meaning, Definition of Planning, Function of Planning, Types of Plan/Planning Process- Purpose, Objective, Policies, Procedure,*	4

Lecture	Details of Topic	Weightage
	Practices, Characteristics of Sound Plan	
13	Rules, Programmes and Budget for Planning Components of Business Plan	3
14	Steps in Planning and Implementation Gathering Facts, Analyzing Facts, Forecasting Change, Setting Goals & Results, Developing Alternatives, Evaluating Progress	4
15	Organization- *Meaning, Legal Structure, Sole Proprietorship, Creating a sole Proprietorship, Advantages & Disadvantages* Partnership- Creating Partnership, Characteristics of Partnership Corporation- Creating Corporation, Characteristics of Corporation, Limited, Liability, Continuity of Operation, Tax Aspects, Estate Planning	4
16	Organization Structure – Responsibility, Authority, Accountability Directing : Meaning, Objective of Directing, Personnel Management, Finding OR Recruiting People, Selecting the Right Person, Job Orientation, Compensation & Fringe Benefits, Evaluating performance, Training & Development, Promotion & Advancement, Terminations & dismissal	5
17	Motivation : Meaning, Different ideas for Managing & Motivating People, Mallow's Need Hierarchy, Motivators & Hygienic Factors	3
18	Controlling : Meaning and Concept, Ordering : Meaning and Concept Leading : Meaning and Concept, Supervision : Meaning and Concept Communication : Meaning and Concept	2
19 & 20	Capital Management and Financial Management Definition of capital, Types of capital, Assess capital, Shares, Debentures, Ploughing back of earnings, Managing agent, Public deposit, Hire purchase, Leasing, Trade credit Importance of Capital and Financial Management Balance Sheet- Meaning, Concept, Importance, Precautions in preparing the balance sheet of business farm Study of different test Ratios- Current Ratio, Intermediate Ratio, Net Capital Ratio, Current Liability Ratio, Debt Equity Ratio, Equity Value Ratio	6
21	Profit & Loss Statement- Meaning, Concepts, Hypothetical Form of Profit & Loss Statement, Study of different Financial Test Ratio- Capital turnover Ratio, Rate of return on investment, Net Farm Income, Net return to total capital	4
22 & 23	Marketing Management:Meaning of Marketing, Definition of Marketing, Concepts of Marketing- Exchange concept, Product Concept, Marketing Myopia, Sales Concept, Difference between Marketing and Selling, Features of Marketing Concept- Consumer Orientation, Integrated Management Action, Consumer Satisfaction.	7

Lecture	Details of Topic	Weightage
	Realizing the organizations goals including profit	
24	Marketing Mix : Meaning, 4 Ps of Marketing, Product Variable, Place Variable, Price Variable, Promotion Variables. Marketing Strategies. Consumer behaviour analysis	4
25 & 26	Market Segmentation - Meaning and concept of Market Segmentation, Importance Role of Market Segmentation, Methods of Market. Product Life Cycle : Meaning, Stages of Product Life Cycle, Market Pioneering stage, Market growth stage, Market Maturity stage, Market decline stage. Sales and Distribution Management : Meaning, Management of Sales and Distributions, Price Policy - Meaning of Price Policy, Objectives of Price Policy, Pricing Methods, Prices at various stages of Marketing	7
27 & 28	Project : Meaning of Project, Definition of Project, Concept of Project, Types of Agricultural Projects- Water Resource Development Projects, Agricultural Credit Projects, Agricultural Development Projects, Agro-Industries & commercial Development Project. Phases in Project Cycle :Conception OR Identification, Formulation OR Preparation of the Project, Appraisal OR Analysis, Implementation, Monitoring, Evaluation, Criteria for section of Agricultural Projects	7
29 & 30	Methods of Project Appraisal: Undiscounted Measures-Payback Period, Proceeds per Rupee of Outlay, Average, Annual Proceeds of Rupee Outlay. Discounted Measures- Net Present worth (NPW), Benefit Cost Ratio (B:C Ratio), Internal rate of Return (IRR), Profitability India, Appropriate Selection of Choice Indicator. Sensitivity Analysis	6
31 & 32	Guide lines for project preparation report- Summary & Conclusion, Introduction, Back ground, Project Rationale, Project Area, The Project, Organization & management, Production, Markets & Financial results, Benefits & Justification. Outstanding Issues Preparation of Project reports for various Activities in agriculture & allied sectors : Dairying, Poultry, Fisheries, Agro-Industries, etc.	4
	Total	**100**

b) Practical

Exercise	Title of Exercise
1.	Study of Input Market : Seed Fertilizer, Pesticides
2.	Study of Output market : Grain, Fruits, Vegetable, Flower
3.	Study of Product Market : Retail trade commodity trading, value added products
4.	Study of Financing Institutions, Co-operatives, Commercial Banks
5.	Study of Regional Rural Bank
6.	Study of Agribusiness Finance Limited

Exercise	Title of Exercise
7.	Study of NABARD
8.	Study of Financial Criteria for appraisal of the Project
9.	Appraisal of Irrigation Project
10.	Study of Financial Test Ratios for Evaluation Agro based Industries
11.	Study of Methods of Project Evaluation
12.	Case study of Agro based Industries
13.	Visit to Financial Institution
14.	Study on E-Commerce of Agricultural Commodities
15.	Visit to Export Market of Fruits/Vegetables/Flowers/Grains
16.	Visit to Processed Industries/Malls/Producer's Companies

Suggested Readings:

1) *Agribusiness Management by Dr. Shivaji Nagpure & Dr. R.G. Deshmukh, M/s. AGROMET Publishers, Nagpur.*
2) *Indian Agriculture & Agri-Business Management by Dr. Smita Diwase, M/s. Scientific Publishers, Jodhpur, Rajasthan.*
3) *Agricultural Finance & Management by S. Subha Reddy, & P. Raghu Ram, M/s. Oxford IBH Publishing Co. Pvt. Ltd., New Delhi.*
4) *Agri Business Management by Dr. J.S. Amarnath & Dr. A.P.V. Samvel, M/s. Satish Serial Publishing House, Delhi-110033.*
5) *The Agribusiness Book by Mukesh Pandey, Deepali Tewari, M/s. ibdc Publishers, Lukhnow (U.P.), Pin-226 001.*
6) *Economics analysis of Agricultural Projects by J. Price Gittinger, M/s. The Economics Development Institute/World Bank, Washington D.C.-20433, U.S.A.*

Course :	*EXTN 355*		***Credit:***	*2(1+1)*	***Semester-V***
Course title:	*Entrepreneurship Development and Business Communication (Common Course)*				

Syllabus

Theory

Entrepreneurship development

- Entrepreneur : Meaning, definitions, characteristics of entrepreneurship
- Assessment of entrepreneurship skills, identifying potential entrepreneurs
- Entrepreneurship development –Concept of entrepreneurship, Process of entrepreneurship development,
- Achievement motivation and entrepreneurship development
- Generation, incubation and commercialization of business ideas and innovations
- SWOT analysis : Concept and technique
- Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs/SSIs)

- *Supply chain management, Time management and Total quality management*
- Market Survey : Meaning, objectives, methods of conducting survey
- Formulation of project, financial analysis of project

Business Communication

- Communication – Meaning and process of communication
- Communication skills for entrepreneurship – Written communication, Verbal communication, Investigating and analyzing, Planning and Organizing, Negotiating and persuading, Cooperative (Team work), Leadership and Numeracy
- *Developing different skills for entrepreneurship - Leadership Skills, Speaking Skills, Listening Skills, Organizational skill , Managerial skills, Problem solving skill,*
- Writing Skill – Business letter, letters of enquiry, quotation, orders, and tenders, complaint letter
- Oral presentation skills – Preparation, presentation and evaluation
- Advertisements – Meaning, types, forms, functions

Practical

1. Assessing entrepreneur potential
2. Assessment of problem solving ability
3. Exercises in creativity
4. Conducting market survey to know the demands for different products
5. Preparing advertisements for popularization of products and news writing
6. Preparing project proposals
7. Individual and group presentations and evaluation of presentation
8. Telephonic conversation : Rate of speech, clarity of voice, speaking and listening politeness, telephonic etiquettes
9. Conducting meeting – Purpose, procedure, participation, physical arrangements, recording and writing of minutes of meeting
10. Seminar and conferences : Use of body language
11. Conducting mock interviews – testing initiative, team spirit and leadership
12. Group discussion and debates on current topics
13. Visit to entrepreneurship institute/ case study of successful entrepreneurs
14. Presentations by the students

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
1	**Entrepreneur :** Meaning, definitions, characteristics of entrepreneurship	10
2	Assessment of entrepreneurship skills, identifying potential entrepreneurs	5
3	**Entrepreneurship development** – Concept of entrepreneurship, Process of entrepreneurship development	5
4	Achievement motivation and entrepreneurship development	5
5	Generation, incubation and commercialization of business ideas and innovations	5
6	**SWOT analysis :** Concept and technique	10
7	Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs/SSIs)	5

8	Supply chain management, Time management and Total quality management	5
9	**Market Survey :** Meaning, objectives, methods of conducting survey	10
10	Formulation of project, financial analysis of project	10
11	Communication – Meaning and process of communication	5
12	Communication skills for entrepreneurship – Written communication, Verbal communication, Investigating and analyzing, Planning and Organizing, Negotiating and persuading, Cooperative (Team work), Leadership and Numeracy	5
13	Developing different skills for entrepreneurship - Leadership Skills, Speaking Skills, Listening Skills, Organizational skill , Managerial skills, Problem solving skill	5
14	Writing Skill – Business letter, letters of enquiry, quotation, orders, and tenders, complaint letter	5
15	Oral presentation skills – Preparation, presentation and evaluation	5
16	Advertisements – Meaning, types, forms, functions	5
	Total	**100**

b) Practical

Exercise	**Topic**
1	Assessing entrepreneur potential
2	Assessment of problem solving ability
3	Exercises in creativity
4	Conducting market survey to know the demands for different products
5	Preparing advertisements for popularization of products and news writing
6	Preparing project proposals
7	Individual and group presentations and evaluation of presentation
8	Individual and group presentations and evaluation of presentation
9	Telephonic conversation : Rate of speech, clarity of voice, speaking and listening politeness, telephonic etiquettes
10	Conducting meeting – Purpose, procedure, participation, physical arrangements, recording and writing of minutes of meeting
11	Seminar and conferences : Use of body language
12	Conducting mock interviews – testing initiative, team spirit and leadership
13	Group discussion and debates on current topics
14	Visit to entrepreneurship institute/ case study of successful entrepreneurs
15	Presentations by the students
16	Presentations by the students

Suggested Readings

1. *Akhouri, M.M.P., Mishra, S.P. and Sengupta, Rita (1989). Trainers Manual on Developing Entrepreneurial Motivation, NIESBUD, New Delhi*

2. *Betty, Gorddan B. (1979). Entrepreneurship, Playing to Win, Taraporewala, Mumbai*
3. *Entrepreneurship Development Institute in India (1987). Developing New Entrepreneurs, EDII, Ahmedabad, NISIET, Library : 338.93/EDI/87/25104.*
4. *Mancuso, Joseph (1974). The Entrepreneurs Handbook, Vol.I& II, Artech House Inc. USA.*
5. *Patel, V.G. (1987). Entrepreneurship Development in India and its relevant Developing Countries, Entrepreneurship Development Institute of India, Ahmedabad, NISIET, Library : 338.93 (540)/PAT/87/25103.*
6. *Singh, A.K., Lakhan Singh, R. and Roy Berman (2006). Dimensions of Agricultural Extension, Aman Publishing House, Meerut.*
7. *MondalSagar and G.L.Ray (2009). Text Book of Entrepreneurship and Rural Development. Kalyani Publishers, Ludhiana. ISBN 978-81-272-5599-2*

Course :	*PATH 354*		***Credit:***	*3(2+1)*	***Semester-V***
Course title:	*Diseases of Field and Horticultural Crops and their Management – I*				

Syllabus

Theory:
Symptoms, etiology, disease cycle and management of major diseases of following crops:

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, Khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot; Finger millet: Blast and leaf spot
Groundnut: early and late leaf spots, wilt.Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic.

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight;

Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight;
Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium;
Note: Students should submit 50 pressed and well-mounted specimens.

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
	Symptoms, etiology, disease cycle and management of major diseases of following crops	
	Field crops	
1,2,3	Rice	6
4,5	Maize	5
6,7	Sorghum	5
8	Bajara	3
9	Finger millet	3
	Oilseed	
10	Groundnut	5
	Pulses	
11,12,13	Soybean , Black & green gram	8
14	Pigeonpea	5
	Cash Crop	
15	Caster	5
16	Tobacco	5
	Horticultural Crops	
17	Guava	5
18,19	Banana	5
20,21	Papaya	5
22,23	Pomegranate	5
	Cruciferous vegetables:	
24,25	Cruciferous vegetables	6
26,27	Brinjal, Tomato , Okra	9
28,29	Beans Ginger, Colocasia	6
	Plantation Crops	
30,31,32	Coconut, Tea, Coffee	9
	Total	**100**

b) Practical

Experiment	Topic
	Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Collection and preservation of disease specimen (Note: Students should submit 50 pressed and well-mounted specimens)
1.	Rice: blast, brown spot, bacterial blight, sheath blight, false smut, Khaira and tungro
2.	Maize: stalk rots, downy mildew, leaf spots, Sorghum: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot;
3.	Finger millet: Blast and leaf spot, Groundnut: early and late leaf spots ,wilt.
4.	Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic, Pigeonpea: Phytophthora blight, wilt and sterility mosaic
5.	Black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic,.
6	Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic

7	Guava: wilt and anthracnose; Papaya: foot rot, leaf curl and mosaic, Papaya ring spot,
8	Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top
9	Pomegranate: bacterial blight ,wilt
10	Cruciferous vegetables: Alternaria leaf spot and black rot,
11	Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic
12	Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight,
13	Okra: Yellow Vein Mosaic, Beans: anthracnose and bacterial blight
14	Ginger: soft rot; Colocasia: Phytophthora blight;
15	Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust
16	Field visit for the diagnosis of field problems

Suggested Readings

1) Agrios, GN. 2010. *Plant Pathology*. Acad. Press
2) Diseases of Horticultural Crops fruits (1999) By Verma L.R and Sharma R.c,Indus Publishing company, New Delhi
3) Diseases of fruit crops (1986) By V.N.Pathak ,Oxford & IBH publication, New Delhi
4) Diseases of fruit crops (1986) By R.S.Singh ,Oxford & IBH publication, New Delhi
5) Diseases of Fruits and vegetables (2007) S.A.M.H. Naqvi,Springer Science & Business Media
6) Diseases of Plantation Crops (2014) By P.Chowdappa, Pratibha Sharma IPS 263pp
7) Diseases of Horticulture Crops and their management ,ICAR e-book for B.Sc.(Agri) & B.Tech (Agri) By TNAU pp172
8) Advances in the diseases of Plantation crops & spices (2004) P.Santha Kumari,International Book Distributing Company , 247 pp
9) Mehrotra RS & Aggarwal A. 2007. *Plant Pathology*. 7th Ed. Tata Mc Graw Hill Publ. Co. Ltd
10) Vegetable Diseases : A Colour full Hand book (2006) by Steven T.Koike ,Peter Gladers and Albert Paulus ,Academic Press, pp448
11) Diseases of Vegetables crops by R.S.Singh (1987) Oxford & IBH publication, New Delhi
12) Plant Diseases.(2008) Singh RS. 20088th Ed. Oxford & IBH. Pub. Co.
13) Diseases of Crops Plants in India (2009) By PHI learning Pvt. Ltd, pp 548
14) Diseases of Vegetable crops (2005) by Alferd Steferud ,Biotech Books ,New Delhi
15) Mehrotra RS & Aggarwal A. 2007. *Plant Pathology*. 7th Ed. Tata Mc Graw Hill Publ.Co. Ltd
16) Diseases of Vegetable Crops ,Diagonosis and Management (2014) Dinesh Singh and P.Chodappa, Today and Tomorrow Printers ,pp734
17) Singh H. 1984. *House-hold and Kitchen Garden Pests - Principles and Practices.* Kalyani Publishers.

Course :	*SSAC 353*		***Credit:***	*3(2+1)*	***Semester-V***
Course title:	*Manures, Fertilizers and Soil Fertility Management*				

Syllabus

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures.Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. History of soil fertility and plant nutrition.criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants.Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry.Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils.Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils . Estimation of soil extractable S in soils..Estimation of DTPA extractable Zn in soils.Estimation of N in plants.Estimation of P in plants.Estimation of K in plants.Estimation of S in plants.

Teaching schedule

a) Theory

Lesson	**Topic**	***Weightage*** (%)
1 & 2	History of soil fertility and plant nutrition.	*3*
3 & 4	Soil as a source of plant nutrients, essential and beneficial nutrients and their role. Criteria of essentiality, forms of nutrients in soil.	*5*
5, & 6	Introduction and importance of organic manures. Sources of organic matter, recycling, composition and C:N ratio.	5

Lesson	Topic	*Weightage* (%)
7, 8 & 9	Definition, properties and classification of bulky and concentrated organic manures, their composition and nutrient availability. Preparation of FYM, composts, different methods of composting, decomposition process and nutrient losses during handling and storage.	6
10 & 11	Vermicomposting, green manuring; types, advantages and disadvantages and nutrient availability.	5
12 & 13	Sewage and sludge, Biogas plant slurry; their composition and effect on soil and plant growth.	5
14 & 15	Integrated nutrient management; concept, components and importance.	6
16 & 17	Fertilizer; Definition and their classification; N fertilizers: classification, manufacturing process and properties their fate and reaction in soils.	6
18 & 19	Phosphatic fertilizers, manufacturing process and properties, classification, their fate and reaction in soils.	5
20& 21	Potassic fertilizers: classification, manufacturing process, properties, their fate and reaction in soils. Complex fertilizers their fate and reaction in the soil. Nano fertilizers.	5
22 & 23	Secondary &micronutrient fertilizers: Types, composition, reaction in soil and effect on crop growth. Soil amendments.	5
24	Handling and storage of fertilizers: Fertilizer control order.	3
25 & 26	Mechanism of nutrient transport to plants: Factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities.	6
27,28 & 29,	Chemistry of soil N,P, K, calcium, magnesium, sulphur and micronutrients.	6
30 & 31	Soil fertility evaluation and different approaches.	6
32	Soil Testing (Available nutrients) :Chemical methods and critical levels of different nutrients in soil.	6
33	Plant analysis methods : Critical levels of nutrients, DRIS approach, rapid tissue test, indicator plants. Soil test based fertilizer recommendations to crops.	6
34 & 35	Methods and scheduling of nutrient applications for different soils and crops grown under rain fed and irrigated conditions.	6
36	Factors influencing nutrients use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers.	5
	Total	**100**

b) Practical

Experiment	Topic
1	Principle and application of spectro-photometry / Colorimetry .
2	Principle and application of flame photometry and atomic absorption spectrophotometer (AAS).
3	Determination of moisture from organic manures and its preparation for nutrient analysis.
4	Determination of organic carbon from organic manures by ignition method.
5	Estimation of available nitrogen in soil (Alkaline permanganate method)
6	Estimation of available phosphorus in soil.
7	Determination of available potassium in soil using flame photometer.
8	Determination of exchangeable Ca& Mg in soil by EDTA method.
9	Estimation of available sulphur in soil (Turbidity method).
10	Estimation of DTPA extractable micronutrients from soil using AAS.
11	Estimation of total N from plant sample by Micro Kjeldahl'smethod.
12	Plant analysis for P,K, secondary and micronutrients.
13	Fertilizer adulteration test / identification of adulteration in fertilizer / Detection of adulteration in fertilizers (Rapid test).
14	Determination of nitrate nitrogen content of potassium nitrate.
15	Determination of water soluble phosphorus in superphosphate (Pumberton method).
16	Determination of acid soluble phosphorus from rock phosphate.
17	Determination of total potassium content of muriate of potash (flame photometer).
18	Determination of zinc content from micronutrient fertilizer (EDTA Method).

Suggested Reading

1) *Mariakulandi and Manickam: 1975 : Chemistry of fertilizers and manures.*
2) *Mariakulandi and Manickam (1975) : Chemistry of manures an fertilizers*
3) *Tandon H. L. S. (1994) : Recycling of crop, animal, human and industrial Wastes in Agriculture. FDCO, Delhi*
4) *Krishna and Murthy (1978) : Manual on compost and other organic manures .*
5) *Rakshit A. 2015.Manures Fertilizers and Pesticides Paperback – Import. CBS Publishing; 1ST edition, pp. 266.*
6) *Zhongqi Heand Hailin Zhang) . 2016 . Applied Manure and Nutrient Chemistry for Sustainable Agriculture and Environment Paperback – Import. Springer. pp. 379.*

7) *Havlin , John L, Samuel L. Tisdale (Author), Werner L. Nelson (Author), James D. Beaton (2004).Soil Fertility and Fertilizers (8th Edition) 8th Edition. Published July 23rd 2004 by Prentice Hall. pp. 528.*

8) *Havlin , John L. 2004. Soil Fertility and Fertilizers: An Introduction to Nutrient Management Published July 23rd 2004 by Prentice Hall. pp. 528.*

9) James F. Power, Rajendra Prasad. 1997 .Soil Fertility Management for Sustainable Agriculture. CRC Press Tayloer and Francis Group. .Textbook -pp. 384 .ISBN 9781566702546

10) *ISSS. 2009. Fundamentals of Soil Science. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.*

11) *Das D. K. 2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.*

12) *ICAR Handbook of manures and fertilizers (1971) publication.*

13) *Yawalkar K.S. Manures & fertilizer: (1992).*

14) *Somawanshi, et al. 2012. Laboratory Methods for Analysis of Soil, Irrigation Water and Plants.., Department of Soil Science and Agricultural Chemistry, MPKV., Rahuri. revised Ed. pp. 307.*

15) *Jakson, M.L. 1973. Soil Chemical Analysis. Printice Hall, India, Pvt. Ltd. New Delhi. pp 498.*

16) *Page et. al. 1982. Methods of Soil Analysis, Part 1 and 2. Chemical and Microbiological Properties . 2nd Ed. Soil Science Soc. of America Am. Soc. Agron., Madison, Wisconsin, USA.*

17) Chapman*, H.D., and P.F.* Pratt. 1961. *Methods of analysis for soils, plants and waters. Division of Agricultural Sciences, University of California.*

18) *Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: Pearson Education, ISBN: 978-0133254488.*

19) *ISSS. 2009. Fundamentals of Soil Science. 2nd Ed. Indian Society of Soil Science, New Delhi- 110 012. pp. 728.*

20) *Das, D. K. 2011. Introductory Soil Science, 3rd revised and Enlarged Ed, Kalyani Publisher, Ludhiana. pp. 645.*

21) *Tisdale, S. L. and Nelson, W. L. and Beaqton, J. D. 2010. Soil Fertility and fertilizers. 7th Ed. Macmillan Publishing Company, 445 Hutchinson Avenue, Columbus.*

22) *Yawalkar, K. S. ,Agarwal, J. P. and Bokde, S. 1967. Manures and Fertilizers. Agri-Horticultural Publication.*

23) *Chopra, S. L. and Kanwar, S. L. and Rakshit, J. S. 2014. Analytical Agricultural Chemistry. Kalyani Publisher.*

24) *Hand book of fertilizers use (1980) : FAI publication*

Course :	*AHDS 364*		***Credit:***	*2(1+1)*	***Semester-VI***
Course title:	*Technology of milk and milk products.*				

Syllabus

Theory

Present status of dairy industry in India. Definition and composition of milk.Physico-chemical properties of milk.Microbial quality of raw milk and standards for different market milk.Factors affecting yield and composition of milk.Physico-chemical and microbial standards for different types of milk.Nutritional importance of milk and its constituents.Reception and processing (Platform test, Chilling, Standardization, Homogenization, Pasteurization, Storage, Marketing) of milk. Classification and composition of milk products (Heat coagulated, Heat and acid coagulated, Evaporated, Fermented Frozen and Fat riched products). Quality management standard and system (BIS/ISI standards, PFA rules, AGMARK, HACCP, FSSAI).International requirement for export of milk and milk products.Preservation of milk and milk products by physical, chemical, biological and herbal preservatives. Utilization of dairy by-product: whey and high acid milk. Packaging of milk and milk products with modern techniques.

Practical

Sampling of milk and milk products.Study of platform tests.Determination of fat by Gerber's method.Determination SNF, TS and specific gravity of milk.Determination of acidity of milk.Determination of adulteration in milk and milk products.Standardization of milk by Pearson's method.Study of cream separator and separation of cream. Preparation of flavoured and chocolate milk. Preparation of *Khoa, Basundi*and *Rabri.* Preparation of *Paneer,Channa* and*Rassogolla.*Preparation of *Dahi, Chakka* and *Shrikhand.*Preparation of Butter.Preparation of *Ghee.*Preparation of Ice-cream and *Kulfi.*Preparation of *Pedha* and *Gulabjamun.* Study of cleaning and sanitization of dairy equipments.

Teaching Schedule

a) Theory

Lecture	Topic	Weightage (%)
1	Present status of dairy industry in India	6
2	Definition of milk, composition of milk of different livestock species	7
3	Physico-chemical properties of milk	6

4	Factors affecting yield and composition of milk	7
5	Microbial quality of raw milk and standards for different market milk	9
6	Nutritional importance of milk and its constituents	4
7	Reception , standardization and homogenization of milk	4
8	Pasteurization of milk and its methods	6
9	Chilling, storage and marketing of milk	5
10&11	Classification and composition of Indigenous milk products	10
12	Quality management standard and system (BIS/ISI standards, PFA rules, AGMARK, HACCP, FSSAI)	7
13	International requirements for export of milk and milk products	6
14	Preservation of milk and milk products by physical, chemical, biological and herbal preservatives	7
15	Utilization of dairy by-products like whey and high acid milk	8
16	Packaging of milk and milk products with modern techniques	8
	Total	**100**

b) Practical

1. Study of platform tests and sampling of milk and milk products
2. Determination of fat by Gerber's method
3. Determination SNF, TS, specific gravity and acidity of milk
4. Determination of adulteration in milk and milk products
5. Standardization of milk by Pearson's method
6. Study of cream separator and separation of cream
7. Preparation of flavoured and chocolate milk
8. Preparation of *Khoa, Basundi*and *Rabri*
9. Preparation of *Paneer,Channa* and*Rassogolla*
10. Preparation of *Dahi, Chakka* and *Shrikhand*
11. Preparation of Butter
12. Preparation of *Ghee*
13. Preparation of Ice-cream and *Kulfi*
14. Preparation of *Pedha* and *Gulabjamun*
15. Study of cleaning and sanitization of dairy equipments
16. Visit to milk processing plant.

Suggested Reading

1) Milk and Milk Products – Winton and Winton (1993), Agrobios (India), Agro. House, Behind Nasrani Cinema, Chopsani Road, Jodhapur

2) *Milk Testing – Davis J. G. Agrobios (India), Agro. House, Behind Nasrani Cinema, Chopsani Road, Jodhapur.*

3) *Chemistry of Milk and Milk Products – Singh V. B. (1965), Asian Publishers, New mandi, Muzaffarnagar.*

4) *Dairying in India – Gupta, H. A. (1997) Kalyani Publisher, 1/1 Rajinder Nagar, Ludhiana.*

5) *Outlines of Dairy Technology – Sukumar De (2000) Oxford University Press, New Delhi*

Course :	*ELE FST 351*		***Credit:***	*3(2+1)*	***Semester-V***
Course title:	*Food Safety and Standards (Elective)*				

Syllabus

Theory

Food quality: physical, nutritional, microbial and sensory, quality control; Hazards in supply chain, biological, chemical and physical hazards, natural contaminants, allergens, Food adulteration, toxicities due to hazards, Food infection and intoxication, risk analysis, and detection and epidemiology of food borne pathogens. ISO Food Safety Management Systems.potential risks of food borne bioterrorism, bioterrorism protection measures, Personal hygiene and sanitary food handling.

Quality management and quality assurance: Total quality management, good manufacturing practices, good agricultural practices, good laboratory practices; ISO. HACCP: Principles, implementation; Plan documentation, types of records; Auditing: Surveillance, audit, mock audit, third party quality certifying audit, Certification, certification procedures, certifying bodies, accrediting bodies, international bodies.

Risk assessment and management during food preparation. Microbial standards of fresh and processed foods.

Concept of Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006, AGMARK, BIS, Global GAP, Global Food safety Initiative; BRC, SQF, SGS, Food Codex; Export import policy, Labeling issues. export documentation; and food safety.

Practical

Estimation of CFU of water, Estimation of TDS in water.Estimation of *Listeria* and *E. Coli/ Salmonella /Shigella/ Staphylococcus* from food samples.Estimation of fungal toxins from food samples.Heavy metal detection (lead),Estimation of any one commonly used pesticide,HACCP for food industries by taking few models,Study of national and international microbial quality standards,Visit to export oriented food processing industry,

Teaching Schedule

a) Theory

Lecture	Topics	Weightage (%)
1-4	Food quality: physical, nutritional, microbial and sensory, quality control	4
5-9	Hazards in supply chain, biological, chemical and physical hazards, natural contaminants, allergens, Food adulteration, toxicities due to hazards,	5
10-12	Food infection and intoxication, risk analysis, and detection and epidemiology of food borne pathogens.	3
13-15	ISO Food Safety Management Systems.potential risks of food borne bioterrorism, bioterrorism protection measures, Personal hygiene and sanitary food handling.	3
16-18	Quality management and quality assurance: Total quality management, good manufacturing practices, good agricultural practices, good laboratory practices; ISO. HACCP: Principles, implementation;	3
19-21	Plan documentation, types of records; Auditing: Surveillance, audit, mock audit, third party quality certifying audit, Certification, certification procedures, certifying bodies, accrediting bodies, international bodies.	3
22-23	Risk assessment and management during food preparation. Microbial standards of fresh and processed foods.	2
24-25	Concept of Quality management systems in India; Sampling procedures and plans;	2
26-28	Food Safety and Standards Act, 2006; Domestic regulations; AGMARK, BIS, Global GAP	3
29-30	Global Food safety Initiative; BRC, SQF, SGS, Food Codex; Export import policy, Labeling issues. export documentation; and food safety.	2
	Total	**30**

Practical

Exercise	Topics	No. of Experiments
1	Estimation of CFU of water, Estimation of TDS in water.	2
2	Estimation of *Listeria* and *E. Coli/ Salmonella /Shigella/ Staphylococcus* from food samples.	2
3	Estimation of fungal toxins from food samples.	2
4	Heavy metal detection (lead)	2
5	Estimation of any one commonly used pesticide	2
6	HACCP for food industries by taking few models of food industry	2
7	Study of national and international microbial quality standards	2
8	Visit to export oriented food processing industry	2
	Total	**16**

Suggested Reading:

1) *Food Microbiology. W.C. Frazier and D.C. Westhoff, 4th Edn. Tata McGraw-Hill Publishing Company Limited, New Delhi.*

2) *Food Safety Handbook. Ronald H. Schmidt and Gary E. Rodrick. 2003. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.*

3) *Food Safety and Food Quality. R.E. Hester and R.M. Harrison. 2001. Royal Society of Chemistry, Cambridge, UK.*

4) *The Safety of Foods (Sicherheit von Lebensmitteln). GrahamGraham, H. D. (Edit.) 2.*

5) *Auflage. AVI Publishing Co., Inc., Westport, Connecticut (USA)*

6) *Food Chemistry (New Edition).Owin R. Fenema*

7) *Handbook of Food Toxicology. S.S. Deshpande, CRC Press. 2002.*

8) *Food Hygiene and Sanitation. S. Roday,Tata McGraw-Hill Education*

9) *Food Microbiology. M.R. Adams and M.O. Moss*

10) *Food Quality Assurance: Principles and Practices. InteazAlli. 2004. CRC Press, Boca Raton, FL, USA.*

11) *Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices.Michael M. Cramer. 2013. CRC Press, Boca Raton, FL, USA.*

12) Regulatory status of Direct Food Additives. Furia TE.1980. CRC Press.

16) Sensory Evaluation of Food - Theory and Practice. Jellinek G. 1985. Ellis Horwoood.

18) Quality Control in Food Industry. Krammer A &Twigg BA.1973.Vol.I, II. AVI Publ.